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Spatial availability of fish stores in areas of different socioeconomic levels of a coast city

Disponibilidade espacial de peixarias em áreas de diferentes níveis socioeconômicos de uma cidade litorânea

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Resumo

Introdução: O consumo de alimentos *in natura* tem sido estimulado por diversas políticas públicas. Investigações sobre disponibilidade geográfica de locais que comercializam esses alimentos e sua relação com a qualidade da alimentação da população têm sido enfatizadas desde o início do século XXI. *Objetivo:* Identificar a distribuição espacial das peixarias fixas e itinerantes no município de Florianópolis, de acordo com a densidade de estabelecimentos por habitantes, em áreas geográficas de diferentes níveis de renda domiciliar. *Metodologia*: As informações foram obtidas por meio de dados secundários provenientes do setor de Vigilância Sanitária Municipal e de listas telefônicas digitais e impressas. Para a localização geográfica dos estabelecimentos nas 30 áreas de ponderação do município, foi utilizado o software Google Earth®. *Resultados e discussão*: A distribuição espacial das peixarias fixas não contempla 14 (47%) das áreas geográficas de Florianópolis, sendo 9 (64%) atendidas pelo "Projeto Caminhão do Peixe", caracterizado pela comercialização itinerante de pescados. Apesar de não haver diferença estatística, observou-se que os números absoluto e relativo (por habitantes) das peixarias fixas eram mais altos quanto maior era a renda da área geográfica. *Conclusões*: Recomenda-se que futuros estudos procurem relacionar a distribuição ambiental das peixarias à aquisição e ao consumo de pescados em Florianópolis.

Palavras-chave: Comercialização de Produtos. Consumo de Alimentos. Peixes. Ambiente Alimentar. Mapeamento Geográfico.

Abstract

Introduction: Fresh food intake has been stimulated through several public policies. Over the last decades, research has been conducted on the spatial availability of stores that sell this type of food and their relationship with the population's food consumption quality. *Objective*: This study has identified the distribution of stationary and itinerant fish commerce in Florianópolis, a city located in Southern Brazil. Also, we seek to associate the density (ratio of number of fish stores by inhabitants) in areas of different income levels. *Methodology*: Data were collected through secondary data in the records of the Municipal Sanitary Surveillance and in digital and printed telephone directories. For data spatialization, we used the Google Earth software®, which has shown the location of fish stores in 30 geographical areas. *Results and discussion*: The spatial distribution of fish marketing stores in Florianópolis does not address all the geographic areas, but the "Fish Truck," characterized by itinerant marketing of fish, serves most of them. Although there was no statistical difference, the absolute and relative numbers (per inhabitant) of the stationary fish trade were higher, the higher the income of the geographical area. *Conclusion*: Future studies should be conducted to relate the environmental distribution of fish stores to the purchase and consumption of fish in Florianópolis.

Keywords: Products Commerce. Food Consumption. Fishes. Food Environment. Geographic Mapping.

Introduction

Food guides from different countries have recommended regular consumption of fish and other seafood. FAO (Food and Agriculture Organization of the United Nations) recommends ingesting 12 kg fish per capita per year.[1] These foods are rich in unsaturated essential fatty acids and proteins of high biological value. Therefore they are considered healthy and cardioprotective.[2-6]

Among countries with the highest consumption of protein from fish (grams/person/day), it is possible to mention: Japan (17.9 g/day), Republic of Korea (16.7 g/day), Portugal (15.3 g/day) and Norway (15.1 g/day). Data for Brazil indicate an average consumption of 10.6 g/day.[7]

Brazilian fish market presents a series of inter- and intra-regional specificities stemming from sociocultural diversity, ethnic multiplicity and economic aspects that influence dietary habits.[8] For this reason, the per capita acquisition per year of fish and other seafood in Brazil has undergone fluctuations, always being below the world consumption recommendation. The most recent

Brazilian Household Budget Survey (HBS) carried out in the country in 2002-2003 and 2008-2009 have identified some reduction in the annual per capita acquisition of fish, going from 4.59 kg[9] to 4.03 kg,[10] respectively, corresponding to the apparent consumption of this type of food.

Brazil's southern region, even though having two fishing ports (Itajaí and São Francisco do Sul), has observed a decrease of 50% in the average annual per capita acquisition of fish in the last 30 years.[11] In the 1970, it would correspond to 3.2 kg/year.[12] At the end of the first decade of the 21st century, this figure fell to 1.59 kg/year, the lowest fish per capita acquisition in the country. Specifically in Santa Catarina, a state whose capital Florianópolis is located almost entirely on an island, the fish per capita acquisition in 2008-2009 corresponded to only 1.96 kg/year.[11]

This acquisition of low proportions, even in a territory with a significant coastal region, points to the need to evaluate the spatial availability of fish commercialization sites, such as fish markets, since physical access to food commercialization sites may influence different publics, including adults, children and adolescents, to acquire and/or consume products sold by them, whether healthy or not.[13-15] For example, greater environment accessibility to fast food restaurants has been associated with their consumption and with diets with low nutritional value.[16-18] On the other hand, people living in environments with greater access to places selling healthy food are more likely to have a better nutritional quality diet.[19] In relation to adults, those residing near small markets and grocery stores tend to consume more fruits and vegetables.[20] However, when such establishments are supermarkets, results are still divergent, proving to be different according to socioeconomic levels of the areas evaluated and countries studied.[21-23] In general, studies on availability have not addressed fish as an object of analysis.

In this way, together with the physical accessibility evaluation, it is worth investigating the establishments spatial distributions by socioeconomic levels, since both the supply and the purchase of food may be restricted in areas whose inhabitants have insufficient financial resources, negatively affecting the quality of the their residents' diet.[24]

Fish can be bought in supermarkets, fish markets and farmers' markets. But since the 1980s supermarkets have become the main food commercialization channel for final consumers.[25] However, there are differences in consumers' profiles. Sonoda,[25] when evaluating the demand for fish in Brazil in 2002-2003, has observed that supermarkets and fish markets would serve different income levels. While the economically most favored ones seek supermarkets to acquire fish, fish markets are the preference for the less favored social classes.

Considering the importance of fish consumption for human health and the lack of studies showing the spatial availability of fish markets and its relation with diet and food purchase, the objective of this article was to identify the spatial distribution of fish markets in the municipality of Florianópolis according to the establishments density by inhabitants in geographic areas of different levels of household income.

Methods

This is a cross-sectional descriptive study based on the use of secondary data related to the quantity and distribution of stationary and itinerant fish markets in the Brazilian municipality of Florianópolis.

Characterization of the study site

Florianópolis is a municipality located in the south of Brazil, formed, for the most part, by an island (97%). It stands out in the country due to the high Municipal Human Development Index (MHDI) corresponding to 0.847 (very high) in 2010, higher than the country's HDI in the same year, considered high (0.727).[26]

Population estimated for the municipality of Florianópolis in 2016 is 477,798 inhabitants, distributed in a territory of 675,409 km^2, resulting in some population density of 683.3 inhabitants/km^2, with 96.2% of the population in urban areas. According to the 2010 Census, Florianópolis presents 651 sectors in the census network (605 in urban areas and 46 in rural areas), aggregated in 30 weighting areas.[27] Weighting areas are census tracts groupings identified by the Brazilian Institute of Geography and Statistics (IBGE, in the Portuguese abbreviation) as minimum units of analysis when studying populations.

Data collection and analysis

In this study, mapping of fish commercialization sites in the city of Florianópolis was carried out considering stationary fish markets and the "Fish Truck Project" (itinerant fish market), which consists in distributing farmers' market trucks from Brazilian Ministry of Fishing and Aquaculture (MPA, in the Portuguese abbreviation). Since 2009, it sells fish directly to consumers at more affordable prices than in stationary commercialization points.[28]

Fish markets location data have been obtained from secondary sources, which, compared to primary geographical data sources, may have relatively low acquisition costs and generally cover a large geographical area (e.g., the municipal scope).[29]

For identification of stationary fish markets (established in formal addresses), a record was requested from the Sanitary and Environmental Surveillance Office of the Health Department of the Florianópolis City Hall, containing information on the municipality establishments that marketed food in 2013. From this list were identified the fish markets name and address (street, neighborhood and ZIP code). However, in order to guarantee reliability, the information was also triangulated through different data sources, aiming at complementing and checking those

addresses.[30] To that end, consultation was carried out at the printed telephone directory distributed in the municipality and the food commercial establishments register in telephone directories made available in the online format[a] using the entry "fish markets" in the search tool.

For identification of itinerant fish markets in Florianópolis, the website of the Municipal Department of Fishing, Mariculture and Agriculture of Florianópolis was consulted,[b] which is the body responsible for actions related to fishing activities in the municipality. In this electronic page of the Department, the "Fish Truck Project" calendar is made available bimonthly, an initiative aiming to increase marketing and encourage fish consumption. In the calendar it is possible to identify the itinerant fish markets installation sites serving Florianópolis' neighborhoods.

After these steps of identifying the addresses of the stationary and itinerant fish markets, ZIP codes and correct and complete spelling of the addresses were checked through the Brazilian Postal and Telegraph Company official website.[c] Having such information, the process of manual spatialization of the municipality fish markets was carried out using the software Google Earth®, that is, the complete addresses of these establishments were manually spatialized (spatial reference creation based on geographical coordinates). During such process, the resource *Street View*® was used to more accurately identify the location of the establishments.

To characterize the fish markets distribution profile in the municipality, demographic and socioeconomic data were obtained from the residents of Florianópolis from the 2010 Census and aggregated in weighting areas.[27] According to the IBGE, the census tracts demographic data can not be used because of the statistical non-representativeness. In this case, the minimum unit of analysis proposed by the IBGE itself is the weighting area, consisting of a group of census tracts, in which results are statistically significant and can be used for academic analyses.[27]

Results are presented in the form of descriptive statistics from the distribution of stationary and itinerant fish markets by three classes of household income. In grouping the weighting areas information and analysis, the option was for working with the distribution of the average monthly nominal income tercile of households, obtaining: 1st tercile of distribution (US$ 1,395 – US$ 2,180), 2nd tercile of income (US$ 2,181 – U$ 3,021) and 3rd tercile of income (US$ 3,022 – US$ 6,165). The average monthly nominal income found was US$ 2,903. The average nominal income values are presented by IBGE in Brazilian reais (BRL). However, in this article such values are described in US dollars (US$). For conversion, the American dollar average price in August 2010 was considered, in the amount of approximately BRL 1.75, the initial period of 2010 Census data collection.[27]

a http://www.hagah.com.br/; http://www.guiafacil.com/florianopolis/sc/; http://www.telelistas.net/sc/florianopolis

b http://www.pmf.sc.gov.br/entidades/pesca

c http://www.buscacep.correios.com.br/

The density of stationary and itinerant fish markets was calculated per thousand inhabitants in each weighting area and the comparison of these densities in residential areas was also presented using a non-parametric trend test, considering a 5% level of statistical significance.

Results

Table 1 identifies the 30 weighting areas of the municipality per income tercile and the quantity of stationary and itinerant fish markets in each one of them, as well as their density per 1,000 inhabitants. Of the 30 existing areas, 46.7% (n = 14) do not have stationary fish markets, six of which are located in lower income tercile areas and six in areas with higher income terciles (data not shown).

Table 1. Distribution of fish markets by weighting areas, according to monthly household nominal income terciles and density of fish markets per thousand inhabitants – Florianópolis, 2013.

Weighting areas according to of income terciles	Stationary fish markets	Density per 1,000/inhab.	Itinerant fish market	Density per 1,000/inhab.
Areas of lower income weighting	6	0.01*	7	0.05**
Areas of intermediate income weighting	12	0.08*	13	0.09**
Areas of higher income weighting	16	0.11*	5	0.04**

Non-parametric trend test *p 0.811; **p 0.094.

It is also observed that the number and density of stationary fish markets increase proportionally to the area household income but without statistical significance. The density of stationary fish markets in the highest income tercile stands out due to the presence of the municipal public market in the municipality central area, which comprises 13 of the municipality's 34 fish markets (38%).

The geographical distribution of the 34 stationary fish markets in the weighting areas per income tercile can be visualized in Figure 1.

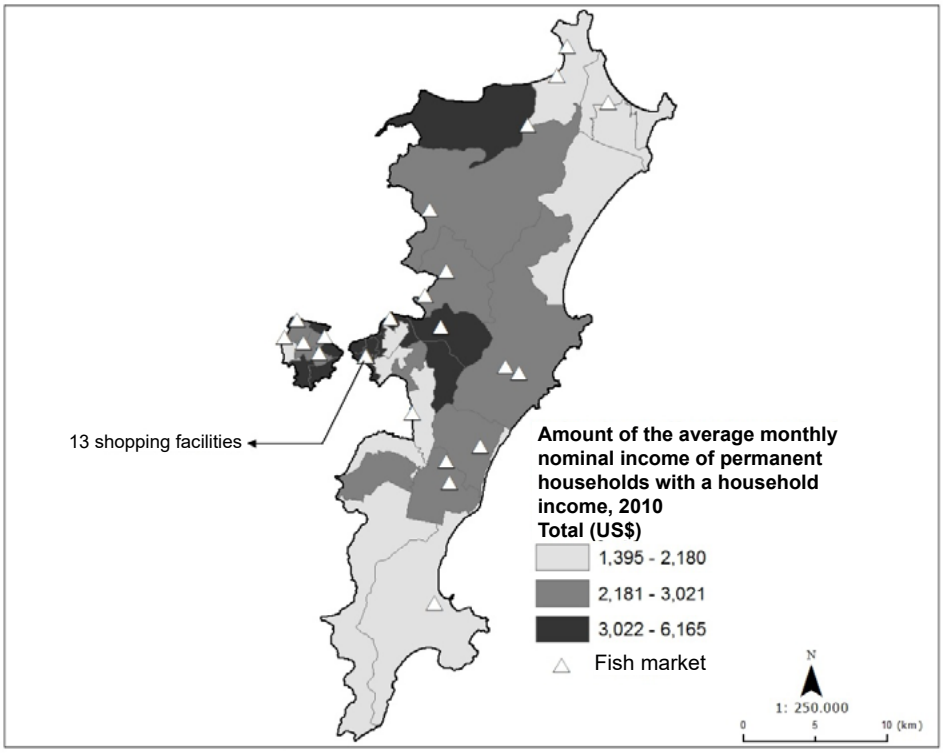

Figure 1. Weighting areas of Florianópolis according to average monthly nominal income of private households in US dollars in 2010 and the location of fish markets. Florianópolis, Santa Catarina, Brazil, 2013.

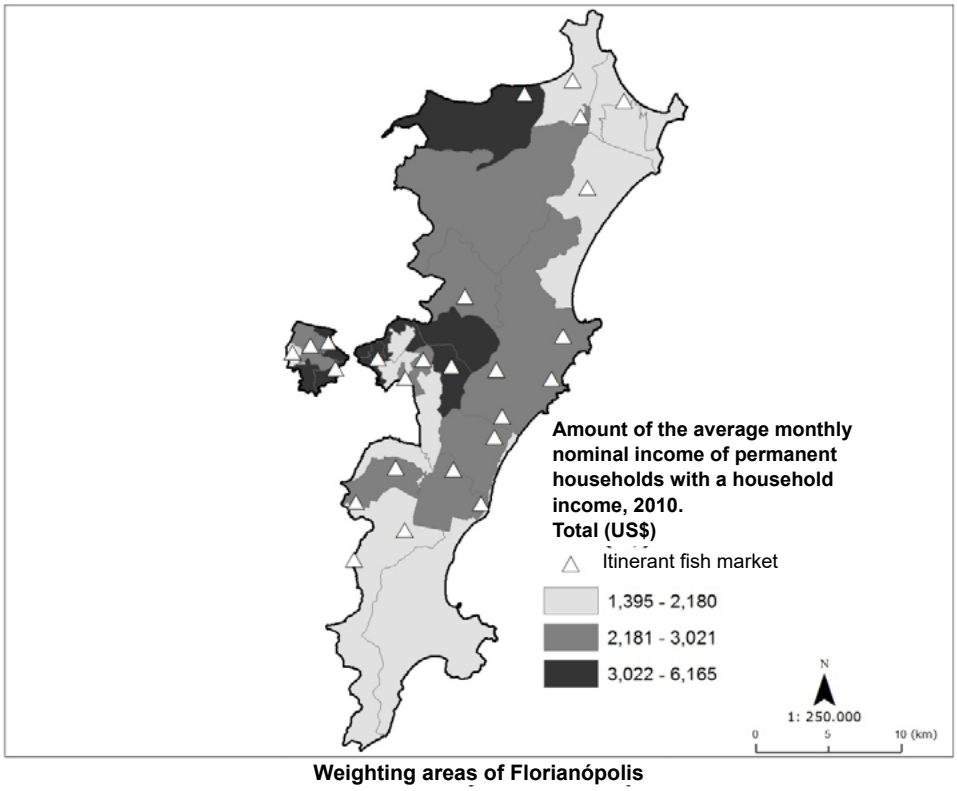

Figure 2. Weighting areas of Florianópolis according to average monthly nominal income of private households in US dollars in 2010 and the location of itinerant fish markets. Florianópolis, Santa Catarina, Brazil, 2013.

In Figure 2 it is possible to identify the geographical distribution of 25 points of commercialization of itinerant fisher markets of Florianópolis, characterizing the route of the "Fish Truck." The density of these establishments per inhabitant is lower than that of stationary fish markets and, unlike that observed in stationary fish markets, the density of itinerants per population is not directly proportional to the household income of the areas. The highest density is found in areas of the average income tercile, although there are no significant differences. According to the Municipality of Florianópolis website, such establishments sell frozen fish, whole or in slices, fillets, crab, fish and shrimp cakes trays, totaling 19 types of products in 1.0-kg trays.

When comparing the spatial distribution of stationary and itinerant fish markets, it is possible to notice that among the 14 residential areas where there are no stationary fish markets, nine (64.3%)

are covered by the itinerant fish market. Among these nine, four are located in regions with the highest tercile of income, while three of them are in the regions with the lowest income tercile.

Discussion

In this article, the spatial distribution of stationary and itinerant fish markets in the city of Florianópolis was identified according to the density of establishments per inhabitant, in locations of household income different levels.

Results showed the absence of stationary fish markets in almost half of the weighting areas, which can characterize food desert and consequent reduction of opportunities for fish consumption. The expression food desert has been used to describe the absence of food outlets in a certain area[31] and may indicate a barrier to the acquisition of certain food items.[32] It is worth noting that, although this study has focused on the evaluation of fish markets availability, which is the preferred site for 13% of the Brazilian population,[32] and the same proportion of fish consumers in the city of Rio Grande, RS,[33] others sites for fish purchase may also be being used by the population of Florianópolis. In the national sample, for example, 24.5% of Brazilians reported buying fish in the supermarket/hypermarket.[32] And in Rio Grande, 64% of respondents cited buying in markets, 39% of them in conventional ones and 25% in public ones.[33] Due to the existence of these other points of fish purchase, the presence of itinerant fish markets in Florianópolis supplying nine (64.3%) areas of the stationary fish markets desert and the fact that one third of the itinerant outlets are located in regions with the lowest income tercile, it is believed that the opportunity to acquire fish in Florianópolis can be had in other areas of food environment, such as markets, supermarkets and itinerant fish markets.

However, findings have also shown some increase trend in the density of stationary fish markets according to the increase of income terciles in the geographical areas. This result may be due to the demand for fish acquisition, which, according to HBS 2008-2009, is different in the different income classes. The purchase of fish in general among the families with the lowest monthly income was around 0.606 kg per capita per year. As for the families with the highest monthly income, the purchase exceeded 3.5 kg.[11] However, it should also be considered that the lower income population tends to be very demanding about prices and to opt for non-freezing of fish, [8, 34] preferentially accessing fish markets, [25] possibly to remedy these two purchase requirements. Also considering that consumers' preference for seasonal fish, in keeping with the food culture, prevails in the Brazilian market, [8] the importance of fish markets is reinforced, which seems to favor fish purchase for the lesser income groups.

In Florianópolis, residents of 25 neighborhoods are served by itinerant fish markets. However, sites selected may vary every two months, according to the communities' request and demands

from residents in each locality. The "Fish Truck" runs through the districts during the morning shift and on working days. Therefore the itinerant fish market periodicity in each neighborhood is about 40 days, which may limit acquisition and consequently consumption by the population. It is important to emphasize that the project proposes the commercialization of products from artisanal fishing and family aquaculture, minimizing intermediaries' actions.[28]

It is also worth mentioning the Florianópolis Public Farmers' Market, which, besides being an architectural heritage, is a traditional point of fish sale. In the weighting area where the market is located there is the highest density of fish markets per inhabitant (1.18 to 1,000/inhabitants), which possibly contributes to fish acquisition by the population. However, because of the concentration of fish markets in the same building, one can also suggest that access to the purchase is geographically restricted, since people who want to acquire fish in the central area of Florianópolis have only one reference point. On the contrary, considering that in Florianópolis some of the weighting areas may house fishermen's cooperatives and that perhaps for this reason they do not have fish markets, the implementation of the 2012/2013/2012 Aquaculture and Fishing Season Plan is mentioned, which has provided for investments to expand aquaculture, modernize fish markets and strengthen the fish industry and trade.[35] Also, the National Food and Nutrition Security Plans (2012/2015 and 2016/2019 PLANSAN, in the Portuguese abbreviation) emphasize the need for adequate technical assistance and technological innovation for artisanal fishermen and family aquaculture, with a view to their productive inclusion and expansion and qualification of fish supplies for domestic consumption and institutional markets, focusing on Brazilian government Food Acquisition Program (PAA, in the Portuguese abbreviation) and National School Food Program (PNAE, in the Portuguese abbreviation). Among priority actions is the expansion of commercial points, such as fish markets.[36] The state of Santa Catarina has published its 1st State Plan for Food and Nutrition Security (2014/2019), reinforcing national guidelines and highlighting the need to create and regulate specific legislation for family agriculture and fishing.[37] Since the aforementioned plans are recent management instruments and require innovative, complex, integrated and intersectoral actions, mechanisms of continuous assessment, monitoring and action-reflection-action on problems and proposed paths become necessary. It is hoped, with such public initiatives, that *in loco* fish sales points have also been encouraged.

Finally, results found and discussed in this study point to a more comprehensive evaluation of fish sales outlets in Florianópolis in order to confirm the need to more homogeneously include fish sales in the municipality, affecting mainly the areas of less favored income groups. This should be made possible through effective public policies, mentioned above, which would take into account the Florianópolis' populational, cultural and dietary characteristics implemented after carrying out more studies similar to this one. Results found can be used to compare studies performed in other regions of the country.

Thus, although the present investigation has not evaluated supermarkets, grocery stores and direct purchases from fishermen, it was able to identify fish markets, the Municipal Public Farmers' Market (located in the central area of the municipality) and the itinerant fish market ("Fish Truck Project"). Considering the vast Brazilian coast, it is believed that studies with this characteristic can be replicated and disseminated to other localities, providing subsidies for better planning and use of spaces that conform the food environment.

It is also suggested that subsequent studies in Florianópolis find out which the preferential spaces for buying fish in the municipality are, in families of different levels of income and which quantities are consumed. It is also important to compile the types of fish acquired by this population and to identify whether the bimonthly frequency of itinerant fish market availability has an impact on fish acquisition and consumption and whether it is necessary to investigate the reasons for which frozen and manufactured fish from outside the municipality are currently marketed in the "Fish Truck" (data not shown; however, reported by the municipal Department of Fishing), contrary to what this public initiative actions recommend.

Conclusion

The spatial distribution of the 34 stationary fish markets in Florianópolis does not serve the 30 weighting areas, suggesting low access to them and the need to study fish consumption in the municipality's population. Some of these areas would be served by the "Fish Truck," characterized by an itinerant fish commercialization, which, however, is available bimonthly in each of the 25 districts that it visits.

Stationary fish markets density per inhabitant increases according to the average monthly income of the weighting areas, a fact that gives rise to investigations on types of fish markets accessed by less and more economically favored families.

Finally, it is suggested that actions be implemented that can effectively contribute to access to fish and seafood consumption. Perhaps one of them is the expansion of the "Fish Truck" routes and frequency. It is also recommended that future studies seek to relate fish markets environmental distribution to fish acquisition and consumption in Florianópolis.

Contributors

Corrêa EN has worked at all stages from designing the study, data collection, data analysis and interpretation to reviewing the article final version; de Abreu AH has collaborated with data analysis and interpretation; Rossi CE has participated in data analysis, writing the article and

its final version; Gabriel CG has participated in data analysis, the article wording and its final version; Neves J has participated in writing the article and its final version; de Pinho MGM has worked on designing the study, analyzing the data and writing the article; de Vasconcelos FAG has participated in the study design and the article final version revision.

All authors of this article are members of a funded research project and have actively participated in several stages of the study. In addition, we highlight the participation of two researchers from a work group with links with other universities (University of Coimbra and VU University), strengthening important institutional partnerships in the group.

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